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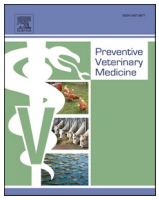

A Dog's Dinner: Factors affecting food choice and feeding practices for UK dog owners feeding raw meat-based or conventional cooked diets☆

Genever Morgan *, Nicola Williams, Vanessa Schmidt, Daisy Cookson, Carrie Symington, Gina Pinchbeck

Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool Leahurst Campus, Leahurst Main Building, Chester High Road, Neston, Wirral CH64 7TE, United Kingdom

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ABSTRACT

Introduction: Food selection is an area of dog ownership where owners have direct control over their pet's wellbeing. While commercial cooked complete foods remain the majority component of many dog diets, there is increasing interest in alternative options including natural and raw ingredients. This study aimed to provide further data regarding feeding practices and diet choice for UK dog owners with a focus on raw meat diets.

Methods: An online survey available to all UK dog owners and advertised through sources including social media and at Crufts was conducted from February to March 2020. Feeding practices and diet choice were assessed, and owners were categorised as either feeding a raw meat diet (RMD) or non-raw diet (NRMD) based on their responses. Descriptive, univariable and multivariable data analyses were undertaken to determine dog and owner factors associated with feeding RMD, and thematic analysis was undertaken on free-text responses.

Results: A total of 1831 owners completed the survey (915 RMD, 916 NRMD) detailing information for 3212 dogs (1754 RMD, 1458 NRMD). Dog breed (German Shepherd), Border Collie, Crossbreed ($p < 0.001$), entire neuter status ($p < 0.001$) and younger age (p 0.022) were associated with RMD feeding. RMD-feeding owners were likely to own > 1 dog ($p < 0.001$). RMD-feeding owners were more likely to cite a 'more natural' diet as a reason for their diet choice, and less likely to cite 'advice from a veterinary professional' compared to those who fed NRMD ($p < 0.001$). They were more likely to seek dietary advice from social media, friends/family and breeders rather than a veterinary surgeon/nurse ($p < 0.001$).

RMD-feeding owners perceived their diet choice to provide a wide range of health benefits, including for coat health, oral hygiene, general digestive system health, anal sac clearance, mobility, performance and behaviour, and perceived NRMD as a health risk for most of these health factors ($p < 0.001$). NRMD-feeding owners perceived RMD to be a risk for bone splinters and foreign bodies ($p < 0.001$).

RMD-feeding owners did not perceive diet to be a risk to their dog, themselves or in-contact dogs or people. In contrast, NRMD-feeding owners perceived the opposite ($p < 0.001$).

Conclusions: Factors affecting dog food selection are multifactorial and complex, with owners who feed RMD and those who feed NRMD having differing views. Further research regarding benefits and risks of different diets is required, however it remains vital that communication regarding the public health risks of RMD is seen as credible to owners and disseminated in a way that reaches the desired audience.

1. Introduction

One of the most important decisions an owner makes during their dog ownership is in what they choose to feed their pet. There is a vast range of food choices available, and while the majority of dog owners choose to feed a conventional cooked proprietary diet, an increasing number are looking to alternatives including raw meat-based diets (RMD) (Dodd et al., 2020). What an owner chooses to feed is proposed to

Abbreviations: RMD, Raw meat-based diet; NRMD, Non-raw meat-based diet; FN, Female neutered; MN, Male neutered; FE, Female entire; ME, Male entire.

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* Corresponding author.
E-mail address: Genever.Morgan@liverpool.ac.uk (G. Morgan).

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be a complex decision based on a combination of many factors (Michel, 2006), including beliefs regarding what constitutes an 'appropriate' food, the owners' perception of their dog's 'preference' for different foods, 'humanisation' of the dog and consideration of the dog as part of the family, social and cultural influences, and the owner's personal ideology for their own personal food choices, reflecting in their choices for their pet (Clemens, 2014; Dodd et al., 2020; Michel, 2006; Viana et al., 2020). Additionally, the owner's pet owning history and prior experience will likely influence this choice. Selection of food is an area of the dog's care where the owner can actively control the wellbeing of their companion (Freeman et al., 2013). As a result, decisions about food choice may be related to perceived health benefits or disease prevention (Rajagopaul et al., 2016).

RMD utilise raw animal-derived ingredients such as muscle, bones and internal organs from mammals, poultry or fish, and may be either home-prepared e.g. using products from the supermarket or butchers, or ready-prepared commercial products (Freeman et al., 2013). The feeding of RMD is an increasingly popular choice for pet dogs amongst dog owners globally (Hinney, 2018; Schlesinger and Joffe, 2011). A survey of pet owners in the USA and Australia identified that although commercial cooked diets comprised the majority of the diet for $\geq$ 90 % of dogs and cats, home prepared diets, raw food and table scraps comprised approximately 25 % of the diet for 17 % of dogs, with provision of bones and raw food at least weekly for 24 % of dogs (Laflamme et al., 2008). A more recent survey of dog owners from Australia, Canada, New Zealand, the UK and USA found that while conventional cooked commercial diets provided the majority of the diet for dogs, only 13 % were fed this exclusively, with many being offered additional raw and/or homemade diets (Dodd et al., 2020). Although data regarding the prevalence of raw feeding in the UK are limited, there was a steep increase in the number of pet food plants producing RMD in the UK up to 2018, which likely reflects an increase in popularity and demand of this diet choice (Withenshaw, S.M. et al., 2020).

Dog owners who choose to feed RMD have been shown to hold particularly strong beliefs regarding the diet choice for their pet (Lenz et al., 2009; Michel, 2006). While perception of their dog's 'preferred' food types and food enjoyment is an important factor in their diet choice, owners who choose RMD are more likely to be driven by the perceived health benefits when selecting their diet choice (Lenz et al., 2009; Morgan et al., 2017). Nutritional quality and the perception of a healthier and more 'natural' diet (with respect to both the diet of ancestral wild canids and to non-processed or preserved ingredients) is also an important consideration (Empert-Gallegos et al., 2020; Morelli et al., 2019). Data regarding pet feeding motivations and practices in the UK, including owners' hygiene practices surrounding food handling, preparation and storage, and views regarding the public health implications of such diets, are limited.

2. Aims

The aims of this study were to identify explanatory factors for diet choice and to explore the reasons, beliefs and sources of information behind owners' diet choices. Food hygiene and storage practices were investigated alongside analysis of risk perception for different food types, and specifically, RMD.

3. Methods

A survey titled 'A Dog's Dinner: A survey investigating dog food selection by UK dog owners' and created using JISC online software was made available via the internet for approximately 6 weeks from the 19th of February to the 31st of March 2020. The survey was open to UK dog owners, regardless of dog food preference, and was advertised via social media, at Crufts 2020 and via letters to a veterinary news publication and the Raw Feeding Veterinary Society (RFVS).

Questions were a combination of multiple choice, Likert scale and free text. For the food preparation and storage hygiene section, owners were directed to either a RMD or non-raw meat-based/cooked conventional diet (NRMD) specific set of questions, depending on their answer to the question 'Do you feed any raw animal material to your dog(s)'. Owners were requested to complete this section once on behalf of all dogs in the household if they were fed the same diet, or individually for each dog that was fed differently up to a possible total of 10 dogs per owner. A subset of questions regarding food preparation, storage and hygiene measures were asked only to owners who fed RMD. The remainder of the survey was completed once on behalf of the entire household, and the same set of questions was answered by all dog owners and included Likert questions on perceived health benefits and risks to the dog and any perceived public health risks associated with diet choice.

All participant responses were anonymous and ethical approval was granted by the University of Liverpool Veterinary Research Ethics Committee (approval number VREC913).

4. Data analysis

Sample size calculations determined that a sample size of 1066 participants was required, using an estimated prevalence of raw feeding of 50 %, a 3 % precision and 95 % confidence intervals.

Data were analysed at both 'dog' level and 'owner/household' level depending on the question.

RMD were classed as those fed raw animal material more than once weekly, and NRMD was classed as all diets comprising of cooked material (e.g., kibble, cans, trays and sachets of cooked commercial wet food, home cooked diets, vegetarian diets, etc). For this study, the very few owners who stated they fed raw animal material, such as a raw bone or raw meat scraps less than once weekly or as an occasional treat were reclassified as 'non-raw'.

Descriptive analyses included frequency and percentages (with 95 % confidence intervals) of categorical and Likert scale responses and comparisons between RMD and NRMD responses were undertaken using the chi square test (or Fishers exact for any groups $n < 5$). Significance was set at $p < 0.05$. Univariable logistic regression was used to generate odds ratios with 95 % confidence intervals to identify dog and owner demographic explanatory variables associated with feeding either a RMD or NRMD. Two separate analyses were performed for owner/household responses and for individual 'dog' level data.

Explanatory variables with a liberal p value of < 0.3 were selected for inclusion into multivariable logistic regression models to evaluate relationships between explanatory variables and the outcome. Correlations between variables were assessed and where highly correlated variables (correlation coefficient > 0.7) were found, the most suitable variable was selected for inclusion into the multivariable regression model. Binary variables were assessed for correlation by examining proportions within each cell. A stepwise backwards elimination method was utilised to sequentially remove variables with a likelihood p value of > 0.05. Eliminated variables were individually re-inserted back into the model and double checked at the end of modelling to ensure that significant or confounding variables had not been omitted. Finally, any biologically plausible interaction terms between variables were tested in the model before the final multivariable model was determined. The 'goodness of fit' of the final model was tested using the Hosmer-Lemeshow test.

The association between feeding either a RMD or NRMD and the food storage, preparation and hygiene practices reported were analysed by univariable logistic regression.

All statistical analyses were undertaken using SPSS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

5. Qualitative analysis

Thematic analysis of the free text responses provided by dog owners to the dog health benefits and risks and public health questions was undertaken using an inductive approach in NVIVO 12 qualitative software (QSR International Pty Ltd. (2018) NVivo (Version 12)).

Responses were coded into 'raw' and 'non-raw' nodes. Following an iterative process of free text analysis, further nodes were generated based on common themes occurring within the free text and quotes from the free text answers were sorted into these nodes accordingly. Responses were compared qualitatively between RMD and NRMD.

6. Results

In total, 1831 dog owners completed the survey, detailing information for 3212 dogs; 915 (49.9 %) indicating that they fed RMD and 916 (50.1 %) that fed NRMD. This included 1754 (54.6 %) dogs fed on RMD and 1458 (45.4 %) fed NRMD.

6.1. Owner demographics and dog signalment

Owner demographics and univariable logistic regression results are shown in Table A1 (Appendix).

Multivariable analysis of owner factors associated with feeding RMD (Table 1) showed that dog owners who owned 2, 3 or 4 dogs were more likely to feed RMD compared to those who owned 1 dog, and those who fed RMD were less likely to have obtained their dog(s) from a friend or colleague. Dogs kept for breeding and working purposes, including farm, were more likely to be fed RMD (Table 1).

There were significant differences in reasons for diet choice ($p < 0.05$) and sources of diet information $p < 0.001$; dog owners who fed RMD were more likely to cite it being more natural, lack of trust of certain foods and behavioural and coat quality as reasons for their diet choice. Owners who fed NRMD were more likely to cite advice from a veterinary professional, safety concerns and cost. Dog owners who fed RMD were more likely to cite a pet food group on social media, dog breeder and a friend or family member as their main source of dietary information, compared to a veterinary surgeon or nurse.

Dog owners provided additional free text comments (RMD = 2612 comments, NRMD = 2058 comments) giving more in depth detail for their diet choice (Table A3–A4). Common themes from those who fed RMD were "believe it to be a more natural diet" (n = 744), "stool consistency" (n = 475), "coat quality" (n = 378) and "lack of trust of certain foods" (n = 209). Conversely, for NRMD, the most prominent answers were "advice from a veterinary professional" (n = 410), "stool consistency" (n = 325), "cost" (n = 231) and "to address existing health concerns" (n = 205). A number of additional themes (that were not listed as tick box options) regarding preventative health emerged, cited by owners feeding both RMD and NRMD, including dental health (n = 10 RMD, n = 4 NRMD), body condition (n = 14 RMD, n = 12 NRMD), nutritional content (n = 20 RMD, n = 56 NRMD) and general health (n = 23 RMD, n = 21 NRMD). 'Convenience' was also important for NRMD owners (n = 25).

Female entire (FE) and male entire (ME) dogs were significantly more likely to be fed RMD than male neutered (MN) or female neutered (FN) dogs (Table 2). Overall, young, and middle-aged dogs were more likely to be fed RMD than geriatric dogs, with the reference category being dogs aged > 12 years old as this was the category represented by the greatest number of dogs fed NRMD.

German Shepherd Dogs, Border Collies, Crossbreeds, and 'Other' breeds were more likely to be fed RMD compared to Labradors, which were the breed with the greatest representation of NRMD dogs. 'Other' included all breeds represented at less than 2 % in this survey. Complete dog signalment data and univariable logistic regression results are shown in Table A2.

Table 1
Multivariable regression model of owner-level (n = 1831) explanatory variables significantly associated with RMD choice in a survey of diet choices made by UK dog owners.

Variable	Category	Odds ratio	CI	p value
Place obtained				
Friend/colleague	No	*Ref*		
	Yes	0.56	0.36, 0.88	0.01
Purpose of dog(s) in household				
Breeding	No	*Ref*		
	Yes	2.60	1.06, 6.37	0.04
Working/farm	No	*Ref*		
	Yes	1.79	1.05, 3.04	0.03
Other*	No	*Ref*		
	Yes	5.62	1.68, 18.73	0.01
Reason for diet choice				
More natural	No	*Ref*		
	Yes	19.06	14.18, 25.62	< 0.001
Lack of trust	No	*Ref*		
	Yes	2.02	1.32, 3.10	< 0.001
Behavioural reasons	No	*Ref*		
	Yes	1.91	1.21, 3.01	0.01
Coat quality	No	*Ref*		
	Yes	1.75	1.29, 2.38	< 0.001
Advice from vet professional	No	*Ref*		
	Yes	0.43	0.28, 0.67	< 0.001
Safety concerns	No	*Ref*		
	Yes	0.43	0.21, 0.90	0.02
Cost	No	*Ref*		
	Yes	0.31	0.21, 0.46	< 0.001
Source of diet information	Veterinary surgeon/ nurse	*Ref*		
	Advertisement	0.53	0.05, 6.38	
	Dog breeder	3.18	1.65, 6.12	
	Dog trainer	1.79	0.77, 4.19	
	Friend/family	2.84	1.45, 5.59	
	Other social media group	1.91	0.73, 5.02	< 0.001
	Personal experience	0.90	0.54, 1.49	
	Pet food company website	0.68	0.27, 1.74	
	Pet food group on social media	17.07	6.52, 44.69	
	Rescue centre/ charity	2.32	0.70, 7.75	
	Other	1.22	0.71, 2.08	
Number of dogs owned	1	*Ref*		
	2	1.42	1.03, 1.97	
	3	3.50	2.08,5.88	< 0.001
	4	4.98	2.44, 10.15	
	5 +	1.08	0.55, 2.13	

Ref = reference category, *denotes all breeds represented at less than 2 %.

6.2. Perceived health benefits and risks of RMD and NRMD

Of the perceived health benefits and risks of each diet there were significant differences between the responses of owners who fed RMD and those who fed NRMD (Table 3).

A higher proportion of owners who fed RMD believed it to be beneficial with regards to a number of health factors, including for skin problems/allergies, coat health, dental disease and general digestive system health, compared to those who fed NRMD (Table 3). Virtually no RMD-feeding owners believed the diet to be a health risk for these factors.

By far the greatest risks of RMD as perceived by owners who fed NRMD were foreign bodies and bone splinters, however far fewer

Table 2
Multivariable regression model of dog-level (n = 3212) explanatory variables significantly associated with RMD choice in a survey of diet choices made by UK dog owners.

Variable	Category	Odds ratio	CI	p value
Dog sex	FN	*Ref*		
	FE	2.45	1.80, 3.33	
	ME	1.69	1.29, 2.22	< 0.001
	MN	0.93	0.76, 1.14	
	Unknown	1.68	1.02, 2.77	
Dog breed	Labrador	*Ref*		
	Border Collie	1.67	1.08, 2.58	
	Cocker Spaniel	1.49	0.95, 2.34	
	Crossbreed	1.48	1.02, 2.16	< 0.001
	GSD	5.21	2.61, 10.43	
	Others	2.01	1.44, 2.81	
	Unknown	1.62	0.97, 2.70	
Dog age	< 6 months	1.98	1.03, 3.78	
	7–12 months	1.07	0.61, 1.89	
	1–4 years	1.41	1.02, 1.94	
	5–8 years	1.63	1.18, 2.26	0.022
	9–11 years	1.18	0.83,1.68	
	> 12 years	*Ref*		
	Unknown	1.18	0.78, 1.81	

Ref = reference category.

owners who fed RMD indicated that they felt it constituted a health risk for these factors.

Feeding NRMD was seen as a health risk by owners who fed RMD for most of the health factors listed, with approximately 50 % or more of RMD-feeding owners indicating that NRMD posed a risk for skin problems and allergies, coat health, dental disease and oral hygiene, general digestive system health, diarrhoea, anal sac clearance, and dog behaviour.

Thematic analysis of owner responses from free text boxes discussing additional dog health risks for RMD and NRMD revealed several further themes, shown with supporting quotes in appendices (Tables A5–A6).

Both owners who fed RMD and NRMD volunteered choking, or unspecified risks of bones, constipation, cost, inconvenience/food freshness, general health concerns, poor quality/poor suppliers, lack of knowledge and safety (including generic risk due to lack of hygiene, nutritional risk; parasites/worms; pathogens/bacteria/contamination; and risk to human health/public health), as additional risk of feeding RMD. Owners who fed NRMD cited obesity/problems regarding weight as an additional risk of RMD, conversely owners who fed RMD regarded feeding NRMD as a risk for weight problems.

Both groups of owners volunteered similar responses around additional health risks of NRMD, with concerns regarding ingredients being highlighted as important, including additives, fillers and ingredient quality. It was acknowledged by both groups that not all cooked, commercial kibble diets were the same and they were perceived to vary in quality.

A commonly cited 'other' health benefit of RMD was palatability, cited by both owners who fed RMD and NRMD. Owners who fed NRMD indicated that nutrition was an important health benefit of NRMD, with quotes centring around it being a nutritionally complete, balanced diet; whereas the main additional benefit of NRMD cited by owners who fed RMD was convenience (Tables A7–A8).

6.3. Public health perceptions and beliefs

There were significant differences in perceptions of risk between owners who fed RMD and those who fed NRMD (Table 4). NRMD feeding owners were more likely to perceive RMD diets as posing a risk to their dog, in contact dogs and people, whereas owners who fed RMD were more likely to perceive "no" or "maybe some" risk to these categories. Most owners who fed NRMD felt that there was no risk to their dog of feeding NRMD whereas owners who fed RMD believed feeding a NRMD did pose a risk to their dog. Most of both groups of owners felt that feeding NRMD posed no risk to themselves or in contact people.

There were fewer free text comments regarding perceived specific risks of NRMD (n = 757, RMD = 499, NRMD = 258) than RMD (n = 1336, RMD = 539, NRMD = 797) from both categories of owners (Table A9–A10). For owners who fed RMD, frequently mentioned specific risks of RMD pertained to good hygiene (or lack of) with regards to its use (n = 177). Owners suggested there was a risk of pathogens and bacteria (n = 57), however, a common theme was that these risks were reduced by appropriate hygiene measures (n = 40).

However, owners who fed NRMD frequently cited pathogens and bacteria as perceived risks of RMD (n = 177) as well increased risk of *Salmonella* (n = 141) and *Campylobacter* (n = 58) infection/transmission with RMD.

The more commonly cited risks of NRMD by both groups of owners involved ingredients (n = 50 RMD, n = 23 NRMD) and allergies (n = 35 RMD, n = 29 NRMD). The belief that the risk of *Salmonella* was increased in NRMD was also often cited by owners who fed RMD (n = 48).

6.4. Owner and dog hygiene measures

There was no significant difference between the responses of dog owners who fed RMD and those who did not with regards to where in the household dogs slept or whether dogs licked human hands or faces. There was, however, a significant difference in where in the household dogs were fed; owners who fed RMD were less likely to feed their dog(s) indoors in a room other than the kitchen, but more likely to feed outside (Table 5).

Questions pertaining to dog bowl hygiene were asked at the dog level (n = 3212). Dogs fed RMD were less likely to have food left and to have the bowl left down, and were more likely to have the bowl removed and cleaned after the meal, although they were also more likely to have any remaining food saved (Table 5).

Food bowls for dogs fed RMD were significantly more likely to be washed after every meal. Additionally, they were more likely to be washed by hand with bleach or washing up liquid, or in the dishwasher compared to rinsing out with water alone.

6.5. Raw only data

An additional subset of questions regarding food preparation, cleaning measures and storage were asked to owners who fed RMD (Table 6). Nearly half of owners stored the RMD in a separate/dedicated pet-food fridge or freezer, although approximately 40 % of respondents stored it in their own fridge or freezer. Most owners who fed RMD believed that freezing killed most bacteria and for RMD products that were supplied frozen, a wide range of defrosting places were utilised; most commonly the kitchen work surface at room temperature was used.

Approximately three-quarters of RMD-feeding owners prepared the dog food in the same place as their own food was prepared e.g., kitchen. When preparing their dog's food, most owners did not use a separate chopping board or utensils or wear gloves.

The majority of RMD-feedings owners indicated that they always cleaned the food preparation area and washed their hands immediately following preparation.

7. Discussion

This study found dog breed, sex/neuter status and purpose were associated with diet choice. Dog age was also important, with younger dogs being more likely to be fed RMD. These results are in agreement with the findings of a previous survey-based study from Italy (Morelli et al., 2019), in which dogs fed a RMD commonly were medium to large breed and entire. Additionally, there was a peak in raw feeding in puppies < 6 months of age.This may be explained by the finding that dog breeders were a significant source of information of RMD feeding

Table 3
Dog Health benefits and risks of feeding either RMD or NRMD as selected by dog owners in a survey of UK dog diet choices. The table details the percentage of RMD and NRMD feeding owners who perceived either health benefit, health risk, no effect or "don't know" for each health variable and the associated p value for the comparison (chi square). Owners who did not provide an answer for this section were omitted.

	Owner response towards RMD						Owner response towards NRMD					
	Owner	Health benefit n (%)	Health risk n (%)	No effect n (%)	Don't know n (%)	p value	Owner	Health benefit n (%)	Health risk n (%)	No effect n (%)	Don't know n (%)	p value
Skin problems/ allergies	**RMD n = 915**	92.1 (843)	0.2 (2)	3.6 (33)	4.0 (37)	< 0.001	**RMD n = 898**	7.5 (67)	67.8 (609)	10.9 (98)	13.8 (124)	< 0.001
	NRMD n = 903	25.0 (226)	9.2 (83)	25.9 (234)	39.9 (360)		**NRMD n = 901**	55.7 (502)	6.3 (57)	19.9 (179)	18.1 (163)	
Coat health	**RMD n = 915**	95.4 (873)	0.0 (0)	2.4 (22)	2.2 (20)	< 0.001	**RMD n = 898**	9.4 (84)	49.3 (443)	23.1 (207)	18.3 (164)	< 0.001
	NRMD n = 903	23.9 (216)	6.0 (54)	31.3 (283)	38.8 (350)		**NRMD n = 902**	63.5 (573)	3.0 (27)	18.8 (170)	14.6 (132)	
Dental disease/ oral hygiene/bad breath	**RMD n = 915**	90.9 (832)	0.4 (4)	5.8 (53)	2.8 (26)	< 0.001	**RMD n = 898**	4.6 (41)	68.3 (613)	13.7 (123)	13.5 (121)	< 0.001
	NRMD n = 903	22.9 (207)	23.4 (211)	22.0 (199)	31.7 (286)		**NRMD n = 902**	53.0 (478)	9.4 (85)	22.4 (202)	15.2 (137)	
Good general digestive system health	**RMD n = 915**	96.5 (883)	0.0 (0)	1.4 (13)	2.1 (19)	< 0.001	**RMD n = 898**	7.2 (65)	62.5 (561)	14.5 (130)	15.8 (142)	< 0.001
	NRMD n = 903	18.3 (165)	34.0 (307)	15.2 (137)	32.6 (294)		**NRMD n = 902**	70.0 (631)	3.7 (33)	13.4 (121)	13.0 (117)	
Vomiting	**RMD n = 915**	44.3 (405)	1.4 (13)	37.8 (346)	16.5 (151)	< 0.001	**RMD n = 898**	2.6 (23)	36.5 (328)	30.2 (271)	30.7 (276)	< 0.001
	NRMD n = 903	4.5 (41)	42.3 (382)	17.8 (161)	35.3 (319)		**NRMD n = 902**	30.8 (278)	3.3 (30)	43.8 (395)	22.1 (199)	
Diarrhoea	**RMD n = 915**	60.3 (552)	1.3 (12)	27.0 (247)	11.4 (104)	< 0.001	**RMD n = 898**	3.5 (31)	51.1 (459)	21.6 (194)	23.8 (214)	< 0.001
	NRMD n = 903	6.0 (54)	45.3 (409)	15.1 (136)	33.7 (304)		**NRMD n = 902**	36.3 (327)	5.1 (46)	39.1 (353)	19.5 (176)	
Anal sac clearance	**RMD n = 915**	75.5 (691)	0.5 (5)	11.5 (105)	12.5 (114)	< 0.001	**RMD n = 898**	2.6 (23)	51.8 (465)	22.2 (199)	23.5 (211)	< 0.001
	NRMD n = 903	12.2 (110)	14.4 (130)	27.2 (246)	46.2 (417)		**NRMD n = 901**	31.3 (282)	6.0 (54)	32.4 (292)	30.3 (273)	
Mobility	**RMD n = 915**	72.3 (662)	0.0 (0)	15.5 (142)	12.1 (111)	< 0.001	**RMD n = 898**	6.6 (59)	39.1 (351)	28.0 (251)	26.4 (237)	< 0.001
	NRMD n = 903	8.2 (74)	8.7 (79)	40.3 (364)	42.7 (386)		**NRMD n = 901**	47.2 (425)	1.8 (16)	28.6 (258)	22.4 (202)	
Performance	**RMD n = 915**	76.7 (702)	0.1 (1)	11.4 (104)	11.8 (108)	< 0.001	**RMD n = 898**	5.3 (48)	41.3 (371)	25.8 (232)	27.5 (247)	< 0.001
	NRMD n = 903	9.1 (82)	6.8 (61)	41.0 (370)	43.2 (390)		**NRMD n = 901**	41.6 (375)	2.0 (18)	34.0 (306)	22.4 (202)	
Behaviour	**RMD n = 915**	73.8 (675)	0.0 (0)	15.6 (143)	10.6 (97)	< 0.001	**RMD n = 898**	4.0 (36)	53.9 (484)	19.7 (177)	22.4 (201)	< 0.001
	NRMD n = 903	9.1 (82)	8.9 (80)	40.5 (366)	41.5 (375)		**NRMD n = 901**	33.5 (302)	4.4 (40)	38.2 (344)	23.9 (215)	
Foreign bodies	**RMD n = 915**	15.2 (139)	16.2 (148)	50.2 (459)	18.5 (169)	< 0.001	**RMD n = 898**	6.3 (57)	18.4 (165)	47.4 (426)	27.8 (250)	< 0.001
	NRMD n = 903	2.1 (19)	62.8 (567)	8.5 (77)	26.6 (240)		**NRMD n = 902**	34.1 (308)	2.5 (23)	46.8 (422)	16.5 (149)	
Bone splinters	**RMD n = 915**	10.1 (92)	19.9 (182)	54.5 (499)	15.5 (142)	< 0.001	**RMD n = 898**	6.5 (58)	15.3 (137)	54.9 (493)	23.4 (210)	< 0.001
	NRMD n = 903	1.7 (15)	65.7 (593)	7.0 (63)	25.7 (232)		**NRMD n = 892**	36.4 (325)	3.1 (28)	44.8 (400)	15.6 (139)	

(increased odds). Whilst obtaining a dog from a breeder was not significant for feeding RMD in the multivariable model in this study, it was significant in the univariable analysis. It would be expected that breeders could influence the diet choices of the puppies being sold, at least initially, as they may impart information to new dog owners including providing samples of food to go home with. Up to a third of respondents to a survey of the feeding practices of dog breeders in the USA and Canada fed RMD to breeding bitches and their puppies (Connolly et al., 2014).

In addition to dog breeders, the main sources of diet information for owners who fed RMD in this study were friends and/or family and, overwhelmingly, pet food groups on social media, as opposed to owners who fed NRMD who were more likely to seek information regarding diet from a veterinary professional. In a previous study in the USA, 20 % of owners who fed RMD identified online resources as their primary source of information regarding diet and nutrition, with only 9% consulting a veterinary professional or animal nutritionist (Morgan et al., 2017). Limited trust in veterinary professionals regarding pet diet was also reported by owners feeding RMD. The utilisation of information resources other than a veterinary professional for dietary advice and information for RMD has been seen in other survey-based study findings (Morelli et al., 2019), and others have also reported that owners who feed RMD lack trust in veterinary professionals with regards to pet diet and nutrition compared to owners who feed a conventional NRMD diet (Connolly et al., 2014; Rajagopaul et al., 2016). In the UK, Empert--Gallegos et al. (2020) observed that owners who fed RMD rated their veterinary surgeon's knowledge regarding canine nutrition as lower, and their own knowledge higher, than owners who fed NRMD. Therefore, owners who choose RMD may not trust vets regarding diet advice as they believe they have limited knowledge.

The reasoning behind the choices made by owners regarding their diet, and the perceived health risks and benefits of the diets in this study,

Table 4
Risk perception by UK dog owners regarding feeding RMD and NRMD selected in a survey of dog diet choices by owners who feed RMD (N = 915) and NRMD (N = 916).

Level of risk	Diet type fed by owner	Owner response to RMD % (n = 915 RMD, 916 NRMD)						Owner response to NRMD % (n = 915 RMD, 916 NRMD)					
		Yes, there is a risk	There may be some risk	There is no risk	Don't know	No answer	p value	Yes, there is a risk	There may be some risk	There is no risk	Don't know	No answer	p value
Risk to your dog	**RMD**	1.3 (12)	21.3 (195)	74.9 (685)	2.0 (18)	0.5 (5)	< 0.001	43.8 (401)	35.4 (324)	14.2 (130)	5.0 (46)	1.5 (14)	< 0.001
	NRMD	44.3 (406)	32.0 (293)	8.0 (73)	14.3 (131)	1.4 (13)		2.8 (26)	32.8 (300)	54.9 (503)	8.3 (76)	1.2 (11)	
Risk to you	**RMD**	4.3 (39)	32.3 (296)	62.1 (569)	0.8 (7)	0.4 (4)	< 0.001	4.2 (38)	19.1 (175)	67.2 (615)	8.0 (73)	1.5 (14)	< 0.001
	NRMD	46.9 (430)	24.8 (227)	14.5 (133)	12.3 (113)	1.4 (13)		0.2 (2)	6.4 (59)	84.3 (772)	7.9 (72)	1.2 (11)	
Risk to in-contact dogs	**RMD**	0.5 (5)	6.6 (60)	89.0 (814)	3.5 (32)	0.4 (4)	< 0.001	3.0 (27)	12.0 (110)	72.6 (664)	10.9 (100)	1.5 (14)	< 0.001
	NRMD	33.8 (310)	21.1 (194)	21.7 (199)	21.8 (200)	1.4 (13)		0.3 (3)	5.9 (54)	84.4 (773)	8.2 (75)	1.2 (11)	
Risk to in-contact people	**RMD**	1.9 (17)	16.8 (154)	78.4 (717)	2.5 (23)	0.4 (4)	< 0.001	3.4 (31)	14.0 (128)	70.7 (647)	10.4 (95)	1.5 (14)	< 0.001
	NRMD	39.5 (362)	18.7 (171)	20.9 (191)	19.5 (179)	1.4 (13)		0.1 (1)	5.0 (46)	85.4 (782)	8.3 (76)	1.2 (11)	

were clearly highly complex and based on a range of factors. There were distinct differences between owners who chose to feed RMD and those who chose NRMD. Owners who fed NRMD were most likely to choose the diet based on cost and advice from a veterinary professional. According to our model, safety concerns may also be one of the reasons NRMD feeders choose not to feed RMD. This result is similar to the findings of a previous UK study, where owners who fed NRMD cited terms such as 'expensive', 'time' and 'risk' as reasons for why they did not feed RMD (Empert-Gallegos et al., 2020).

The most likely reason for choosing RMD in this study was that it was perceived to be a more natural choice of diet, with other significant reasons being a lack of trust of certain foods, behavioural reasons, and improved coat quality. This is in agreement with other similar survey-based work, with 69 % of owners who fed RMD in one recent study citing they chose the diet as they felt it respected the 'animal nature' of the dog (Viegas et al., 2020), and 93 % of owners in another study choosing RMD as they believed it was a more natural, 'species-appropriate' diet (Bulochova and Evans, 2021a). Additionally, the survey by Morelli et al. (2019) identified important reasons for choosing RMD were to respect the 'ancestral carnivorous nature' of the dog and to 'avoid commercial food', further supporting the findings in this study. It should be noted that in this study, the term 'natural' was not specifically defined, therefore as seen in the free text comments it could have been interpreted in terms of ingredients (not processed or preserved) or in terms of the perceived diet of wild canids in nature. Both interpretations were discussed by owners in this study.

The association between the lack of trust of commercial NRMD and pet food manufacturers, and the choice to feed a non-commercial diet has been observed in previous work (Connolly et al., 2014) and has been linked to concerns regarding the origin of the constituent parts and ingredient contamination (Bulochova and Evans, 2021b; Dodd et al., 2020). One study found that owners who fed a proportion of more than 50 % of their pet's diet as non-commercial food having increased concerns regarding commercial pet food and the pet food industry (Michel et al., 2008). In this study, both a lack of trust of component ingredient quality and of large commercial pet food companies in general were discussed by RMD-feeding dog owners.

In this study, owners who fed RMD perceived a broad range of multiple health benefits to be associated with this diet choice, with strongly opposing views regarding NRMD This is unsurprising as previous studies have observed similar findings, reporting that owners who fed RMD were more likely to be driven by perceived health benefits and treatment effects compared to those who did not feed raw animal material (Lenz et al., 2009; Morgan et al., 2017). Furthermore, in previous survey- and netnography-based studies, the most common owner-reported health benefits of RMD were associated with muscle mass improvement, teeth, coat and general health (Bulochova and Evans, 2021b; Empert-Gallegos et al., 2020; Morelli et al., 2019). However, a critical review of the evidence surrounding the feeding of raw diets by Schlesinger and Joffe (2011) concluded that the evidence for nutritional benefit (or risk) was low level. There have been some studies since which have attempted to provide evidence in relation to the benefits of raw diets with respect to dental calculus (Marx et al., 2016), urinary calcium and oxalate excretion (Dijcker et al., 2012), digestibility and the faecal microbiome (Sandri et al., 2017) and owner-reported reduction in development of atopy when fed in puppyhood (Hemida et al., 2021). However, the body of published evidence to support the generalised claims of the benefits regarding RMD is lacking and further research is required to substantiate them.

There was some agreement in the most cited 'other' health benefits and risks of RMD and NRMD from the free text responses, with both sets of owners regarding palatability as an additional health benefit of RMD and discussing concerns regarding ingredients as an additional health risk of NRMD. Whilst both groups of owners commented on concerns regarding nutrition with regards to RMD, this was the most commonly cited additional health risk of RMD for RMD-feeding owners, with many stressing the importance of 'research' into balancing the RMD's properly. There is currently very little good quality evidence regarding the nutritional quality, 'optimum' composition, and benefits of RMD. This highlights the importance of further research into this area, as there is a clear desire from owners regarding nutritional information, and the importance of disseminating this information in a way that it reaches the desired audience. Interestingly dog owners who feed RMD were less likely to consult a veterinary professional regarding their diet choices and more likely to seek advice from non-validated, anecdotal, or opinion-based resources.

This highlights an opportunity for veterinary professionals to better engage with owners who feed RMD, as they are more able to inform on diet composition, especially with regards to dogs at different life stages or disease states. Feeding nutritionally incomplete homemade RMD has been linked to nutritional deficiencies, secondary hyperparathyroidism, osteopenia and myelopathy in young dogs (Hall et al., 2020; Taylor et al., 2009).

Crucially, veterinary professionals are in a position to advise on food safety and public health risks, including transmission of zoonotic diseases including Shiga-toxin producing *E. coli* O157 (STEC), *Salmonella*

Table 5
Univariable results for owner-level (n = 1831) and dog-level (n = 3212) hygiene measures comparing RMD and NRMD feeding responses in a survey of diet choices made by UK dog owners.

Variable	Category	n	% of total	Diet choice % (n)		Odds ratio	CI	p value
(Owner)	(Owner)			*Non-Raw*	*Raw*			
Totals		**1831**		**50.0 (916)**	**50.0 (915)**			
Where dog(s) in household eat	Indoors, in the kitchen	1317	71.9	70.6 (647)	73.2 (670)	*Ref*		
	Indoors, room other than kitchen	404	22.1	23.5 (215)	20.7 (189)	0.79	0.63, 0.99	
	Outside	86	4.7	4.1 (38)	5.2 (48)	3.31	1.98, 5.51	< 0.001
	Other	21	1.1	1.4 (13)	0.9 (8)	1.34	0.56, 3.19	
	Unknown	3	0.2	0.3 (3)	0.0 (0)	0.5	0.05, 5.54	
Where dog(s) in household sleep	Indoors in room other than bedroom	903	49.3	51.9 (475)	46.8 (428)	*Ref*		
	Bedroom on human bed	454	24.8	23.9 (219)	25.7 (235)	1.19	0.95, 1.49	
	Bedroom on floor/in dog bed	419	22.9	21.5 (197)	24.3 (222)	1.25	0.99, 1.58	0.25
	Outside kennel	18	1	1.1 (10)	0.9 (8)	0.89	0.35, 2.27	
	Other	35	1.9	1.5 (14)	2.3 (21)	1.66	0.84, 3.31	
	Unknown	2	0.1	0.1 (1)	0.1 (1)	1.11	0.07, 17.80	
Whether dog(s) lick human face/hands	Never	164	9	9.8 (90)	8.1 (74)	*Ref*		
	Yes, but rarely	737	40.3	42.4 (388)	38.1 (349)	1.09	0.78, 1.54	
	Yes, quite often	559	30.5	28.3 (259)	32.8 (300)	1.41	0.99, 2.00	0.12
	Yes, frequently	364	19.9	19.2 (176)	20.5 (188)	1.3	0.90, 1.88	
	Unknown	7	0.4	0.3 (3)	0.4 (4)	1.62	0.35, 7.48	

Variable	Category	n	% of total	Diet choice % (n)		Odds ratio	CI	p value
(Dog)	(Dog)			*Non-Raw*	*Raw*			
Totals		**3212**		**45.4 (1458)**	**54.6 (1754)**			
What is done with bowl/feeding utensil after eating?	Food left, leave bowl down	222	6.9	12.9 (188)	1.9 (34)	*Ref*		
	Never food left, remove and clean bowl	1911	59.5	45.0 (656)	71.6 (1255)	10.58	7.25, 15.43	
	Never food left, leave bowl down	779	24.3	31.8 (464)	18.0 (315)	3.75	2.54, 5.56	< 0.001
	Remove bowl, throw away food	144	4.5	5.2 (76)	3.9 (68)	4.95	3.03, 8.08	
	Remove bowl, save food	143	4.5	4.4 (64)	45.0 (790)	6.83	4.17, 11.16	
	Unknown	13	0.4	0.7 (10)	0.2 (3)	1.66	0.43, 6.34	
Bowl/feeding utensil washing method	Rinse out with water only	142	4.4	7.1 (103)	2.2 (39)	*Ref*		
	Hand wash with washing up liquid	2027	63.1	66.1 (964)	60.6 (1063)	2.91	1.99, 4.25	
	Dishwasher	892	27.8	24.1 (351)	30.8 (541)	4.07	2.75, 6.03	< 0.001
	Hand wash with bleach	24	0.7	0.3 (4)	1.1 (20)	13.21	4.24, 41.08	
	Other	119	3.7	1.9 (28)	5.2 (91)	8.58	4.90, 15.05	
	Unknown	8	0.2	0.5 (8)	0.0 (0)	**	**	
Bowl/utensil washing frequency	Never	61	1.9	3.0 (44)	1.0 (17)	*Ref*		
	Less frequently	1638	51.0	67.8 (988)	37.1 (650)	1.70	0.97, 3.01	< 0.001
	After every meal	1495	46.5	28.5 (416)	61.5 (1079)	6.71	3.79, 11.88	
	Unknown	18	0.6	0.7 (10)	0.5 (8)	2.07	0.70, 6.13	

spp., *Listeria* spp. and *Campylobacter* spp. These pathogens pose an infectious disease risk for both dogs (Binagia and Levy, 2020; Jones et al., 2019; Martinez-Anton et al., 2018; Morley et al., 2006) and humans, particularly for vulnerable groups such as the immunocompromised or elderly, as discussed later.

However, as previously indicated, this communication should be open and seemingly non-judgemental to ensure constructive discussion regarding dietary concerns and choices (Wales and Davies, 2021).

A frequent health risk of RMD cited by owners who fed NRMD was regarding pathogens, with many owners being aware of zoonotic infectious agents such as *E. coli*, *Salmonella*. and *Campylobacter* species. This, and the concerns regarding foreign bodies and bone fragments, supports the result of the regression model where concern regarding safety was one of the reasons for owners choosing to feed NRMD. Owners who fed RMD also reported awareness of pathogens, but it was not to the same degree. In this study, the vast majority of dog owners who fed RMD perceived RMD to present a low risk not only to their dog, but also to themselves and in-contact dogs and people; and the majority of both NRMD and NRMD-feeding owners overall felt there was no risk to owners or in-contacts from NRMD. Although there has not been a great deal of previous work regarding the owner perception of risk regarding diet choice, these results agree with similar findings of previous studies. Morelli et al. (2019) observed that 94 % of owners who fed RMD considered it safe for pets, Viegas et al. (2020) identified that 99 % owners felt that the handling and feeding of RMD posed no risk to their own health, and Bulochova and Evans (2021a) reported that 89 % of RMD-feeding owners did not perceive RMD to pose a risk of foodborne illness to either themselves or family members, and suggested a perception of low risk regarding foodborne illness and high confidence in the safety of RMD by RMD-feeding owners. Additionally, Lenz et al. (2009) observed that 70 % of owners who did not feed a raw diet either disagreed with, or were indifferent to the statement ‘diets containing

Table 6
Survey responses (number (n) and percentage (%)) from UK dog owners who fed RMD (n = 915) regarding food storage, preparation, and cleaning measures.

Variable	Response	n	%
Total		915	
Storage			
Raw food storage place	Separate/dedicated pet food fridge/ freezer	420	45.9
	My own fridge/freezer	354	38.7
	Multiple places	129	14.1
	Non-temperature-controlled cupboard	4	0.4
	Other	5	0.5
	Unknown	3	0.3
Raw food defrosting place	Kitchen work surface, room temperature	242	26.4
	Fridge	186	20.3
	Work surface in dedicated pet food preparation area, room temperature	154	16.8
	Kitchen sink	108	11.8
	Dedicated pet food sink/microwave	39	4.3
	Dedicated/separate pet food fridge	34	3.7
	Kitchen microwave	10	1.1
	Other	110	12
	Not applicable to me	29	3.2
	Unknown	3	0.3
Opinion on freezing raw meat	Freezing meat kills most bacteria	410	44.8
	Freezing meat does not kill bacteria	202	22.1
	I don't have an opinion on freezing meat	190	20.8
	Freezing meat kills all bacteria	74	8.1
	I don't know	36	3.9
	Unknown	3	0.3
Preparation			
Raw food preparation place	Same area as my own food prepared e.g., kitchen	707	77.3
	Different area to where my food is prepared e.g., utility room, garage	191	20.9
	Multiple places	9	1.0
	Unknown	8	0.9
Separate chopping board/utensils	No	365	39.9
	Separate chopping board and utensils	259	28.3
	Separate utensils	156	17
	Separate chopping board	124	13.6
	Unknown	11	1.2
Wear gloves to prepare raw meat diet	Yes	128	14
	No	772	84.4
	Unknown	15	1.6
Cleaning measures			
Preparation area cleaned immediately	Always	739	80.8
	Usually	135	14.8
	Sometimes	27	3
	Never	7	0.8
	Unknown	7	0.8
Separate cleaning materials	Yes	485	53.0
	No	425	46.4
	Unknown	5	0.5
Hand wash after raw food preparation	1 (Always)	809	88.4
	2 (Less frequently)	81	8.9
	3 (Never)	20	2.2
	Unknown	5	0.5

raw meat are healthy for dogs', which is directly comparable to the result of this current survey where 76 % of owners who fed NRMD answered either 'yes there is a risk' or 'there may be some risk' to their dog regarding the feeding of RMD.

Concerningly, some owners further commented that there was no risk presented to either themselves or their dog from RMD, with additional comments regarding 'scaremongering' in relation to feeding RMD. This suggests that owners who feed RMD are not necessarily aware of the risks that the food itself may pose nor the risks the dog fed the diet could pose with regards to bacterial carriage and shedding around the home and environment. This is of particular concern if the dogs are in contact with immunocompromised people, the elderly, or young children; and would also be of concern for veterinary practices which hospitalise these dogs alongside at-risk patients, or for attending veterinary staff who have close contact with dogs fed RMD during veterinary procedures.

NRMD feeders appear to be aware of the potential contact with bacteria and pathogens in RMD. RMD feeders cited 'good hygiene' was crucial when feeding this diet and that risks could be negated if practicing good food preparation hygiene measures. Although they did not state that bacteria and pathogens were risks, compared to dogs fed NRMD, dogs fed RMD were more likely to be fed outside, have the bowl cleaned immediately after feeding, have the bowl cleaned after every meal and cleaned with more stringent measures such as bleach or the dishwasher than rinsing with water alone. These results suggest that owners who feed RMD may be aware to some extent of the immediate potential foodborne pathogen transmission risks from the food itself, a finding consistent with those of Bulochova and Evans (2021b). On the contrary, in this study, a large proportion of owners who fed RMD also stored and defrosted the diet in the same area as their own food and 77 % of owners prepared the diet in the same place as they prepared their own food, with approximately 40 % of owners using the same utensils for both the RMD and their own food, suggesting inconsistent application of food safety practices. Additionally, the hazardous practice of defrosting food at room temperature was common. These findings are consistent with previous work where owners who fed RMD reported awareness of good food safety practices, however did not consistently implement them (Bulochova and Evans, 2021a, 2021b). Guidelines for safe preparation, storage and handling of raw pet foods are readily available, such as the factsheet from the Pet Food Manufacturers Association (PFMA, available at https://www.pfma.org.uk/raw-feeding-factsheet) and Public Health England (PHE, available at https://www.gov.uk/guidance/raw-pet-foods-handling-and-preventing-infection).

From a public health point of view, the reduced awareness of the potential infectious disease risks posed by RMD as observed in this study is concerning. RMD has been shown by previous studies to harbour pathogenic and zoonotic bacteria including STEC, which can cause serious disease in the young, elderly and immunocompromised (Kaindama et al., 2020; Treier et al., 2021), *Salmonella* spp., *Listeria* spp., *Campylobacter* spp. and *Clostridium perfringens* (Weese et al., 2005; Strohmeyer et al., 2006; Nemser et al., 2014; Nilsson, 2015; van Bree et al., 2018; Hellgren et al., 2019). Additionally, studies have shown that dogs fed RMD may shed *Salmonella* species asymptomatically in their faeces for up to 7 days following consumption of a contaminated RMD meal (Finley et al., 2007; Joffe and Schlesinger, 2002). Finally, an emerging concern regarding the use of RMD is the potential risk for transmission of antimicrobial resistant bacteria (AMR). A growing number of studies have demonstrated the presence of AMR bacteria (including extended spectrum beta lactamase (ESBL) producing-*E. coli*) in RMD foods, and in the bacteria shed within faeces of dogs fed these diets (Bacci et al., 2019; Groat et al., 2022; Leonard et al., 2015; Nilsson, 2015; Schmidt et al., 2015; van Bree et al., 2018; Wedley et al., 2017). There are a lack of studies demonstrating direct transmission of these bacteria from RMD to humans, or dogs fed RMD to humans. However, a recent outbreak of four human cases of STEC in the UK were linked to the provision of raw tripe as dog food (Kaindama et al., 2020). Co-carriage of ESBL-producing *Enterobacteriaceae* has been identified in a small number of households between pet dogs and humans, with the main risk factor for canine carriage being a diet of RMD (van den Bunt et al., 2020), indicating that pet dogs may represent a further reservoir and potential route of transmission for ESBL-producing *Enterobacteriaceae* to humans. Dogs and their owners have close and frequent physical contact, therefore transmission of bacteria from dog to human is plausible. Nevertheless, additional research is required to substantiate this further.

Of note is that the second-most frequently cited specific risk of NRMD by owners who fed RMD was *Salmonella* species. The perception that kibble is of particular risk for *Salmonella* species transmission is commonly identified on RMD-specific social media and online resources. While it is true that *Salmonella* species contamination has been identified, albeit infrequently, in some commercial cooked/dehydrated foods following outbreak investigations in the USA (Behravesh et al.,

2010) and Germany (Schotte et al., 2007), the evidence is clear that the risk of *Salmonella* species contamination remains far greater in RMD than NRMD (Strohmeyer et al., 2006; Nemser et al., 2014; Withenshaw et al., 2020). However, as the variety of pet foods available on the market continues to increase, further work to substantiate these findings is required.

There are some potential limitations to the methodology employed in this study such as inherent bias as a result of self-selection by the participants taking part. The subject of dog food choice is a particularly emotive topic, and this may encourage those who feel particularly strongly for or against one type of diet to participate. Such polarised views may not be representative of those of the wider population The reliability of results is reliant on honesty from the participants when answering the questions, and they may be subject to bias or misinterpretation if participants answer vaguely or provide misleading responses. Furthermore there are risks of bias in these results, particularly regarding food preparation and hygiene measures, in that owners may have answered what they think is the 'correct' answer rather than what they actually do, which could mask the true standard of food hygiene actually occurring within the study population. There is also likely to be some bias towards owners with fewer dogs, and from owners selectively completing the survey for certain dogs within their household to avoid having to complete the survey multiple times. This may lead to misclassification of an owner as RMD or NRMD-feeding if they have only answered the survey for a dog fed a certain diet type and missed another which was fed differently.

Finally, there is likely an over-representation of both owners who feed RMD and veterinary surgeons because of the participant recruitment process, which may not necessarily reflect the wider population, thus the frequency of RMD feeding here should not be viewed as representative of the UK population. The use of social media as a resource for diet information regarding RMD was potentially over-represented in this study as a key component of the recruitment process was via social media. However, social media is undoubtedly an important and readily available means of communication, and the use and limitations of social media as a resource for pet nutrition information has been discussed previously (Hinney, 2018; Morelli et al., 2019). Despite these limitations, clear differences between the responses of owners who feed RMD and those who do not were demonstrated in this study population.

8. Conclusions

From this survey we have observed that owners who choose RMD seek dietary information from sources other than their veterinary surgeon, with resources such as social media being crucial. Reasons for diet choice appear to be multifactorial, however a lack of trust of certain foods and the desire for a seemingly more natural diet choice were important, with an emphasis placed on 'good quality' and 'natural' ingredients.

Although owners who fed RMD were aware and concerned with the possible risks to their dog related to diet choice and appeared to practice some aspects of hygienic food preparation, they appeared less aware of the potential wider reaching infectious disease risks of RMD to in-contact dogs and people. This may represent a general lack of awareness, but there could also be an element of mis-trust of scientific information presented to them based on their own assessment and information from alternative sources, particularly if owners had not previously experienced illness themselves related to the food.

Although further research is required to clarify and quantify the level of risk further, from the findings of this study it is evident that any pertinent information regarding health and safety measures associated with RMD is not only accurate, but also seen as credible to people who choose to feed this diet and directed through the appropriate channels to ensure the wider target audience is reached.

Declarations of interest

None.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.prevetmed.2022.105741.

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